Remarks

Reconsideration of pending Claims 1-5, 7-57, 73, 75-81, 83-96 and 98-121 is respectfully requested.

Claims 6, 74, 82 and 97 have been canceled.

Support for the amendments is discussed below, and no new matter has been added. The claims have been amended to clarify language used in the claims and/or the subject matter claimed. The scope of the claims is intended to be the same as before the amendment.

Rejection of Claims under 35 U.S.C. § 112(1)

The Examiner rejected Claims 1-14, 16-21, 97-100, 103-106 and 112 under Section 112(1) as non-enabled.

The claims have been amended to eliminate the terms "continuous" and "uniform" as unnecessary to the claims.

The claims have also been amended to recite "*about "10-20 angstroms*" as supported at paragraph [0024] ("Preferably, the silicon layer 18 is ..., preferably about 10 to about 20 angstroms thick.")

It is believed that the claims as amended fully comply with the requirements of Section 112(1), and withdrawal of this rejection is respectfully requested.

Rejection of Claims under 35 U.S.C. § 112(2)

The Examiner rejected Claims 99-100 as indefinite under Section 112(2) for lack of antecedent basis.

The claims have been amended to recite the silicon-*containing* gas.

Accordingly, withdrawal of this rejection is respectfully requested.

Rejection of Claims under 35 U.S.C. § 102(b) (Muralidhar)

The Examiner rejected Claims 1-14, 16-21, 97-100, 103-106 and 112 under Section 103(a) as obvious over Muralidhar. This rejection is respectfully traversed.

The claims have been amended to more clearly recite Applicant's method of forming a nitride barrier layer by:

-- forming a silicon layer of <u>*about 10-20 angstroms thick*</u> on a dielectric/oxide layer; and

-- exposing the silicon layer to a nitrogen-containing gas to form a silicon nitride <u>*barrier layer that is effective to inhibit passage of a dopant into the dielectric/oxide layer*</u>.

Muralidhar does not describe Applicant's methods as claimed.

First of all, Muralidhar does <u>not</u> teach forming a silicon layer of *about 10-20 angstroms thick.*

Muralidhar teaches that a desirable size of the silicon nanoclusters is a diameter of <u>*30-70 angstroms*</u> – with 50 angstroms exemplified as a target diameter. See at col. 12, lines 50-53:

> A desirable size of nanoclusters for use in semiconductor memory structures may be between 30 and 70 angstroms, and in some embodiments a target diameter of 50 angstroms may be appropriate. ...

Muralidhar further teaches that the smaller nanoclusters at a diameter of *less than 25 angstroms* will present <u>*problems*</u> with storing charge as required to function effectively. See at col. 15, lines 28-47 (emphasis added):

> FIG. 21 illustrates an expanded cross-sectional view of a plurality of nanoclusters 103 as formed on a tunnel dielectric layer 102. Following deposition of the nanoclusters 103 and the tunnel dielectric 102 on the semiconductor substrate 100, the substrate 100 may be exposed to ambient conditions. *Such exposure to ambient conditions may result in oxidation of the nanoclusters 103 which in turn may result in a number of undesirable effects.* One undesirable effect concerns the reduction in the effective size of the nanoclusters through the consumption of silicon or other composition materials during such oxidation. As a result, if too much oxidation occurs, the resulting size of the nanoclusters may be such that they are incapable of storing charge in the manner required to allow them to effectively function as charge storage elements. *Smaller nanoclusters are less receptive to charge carriers due to reduced cross-sectional area as well as other factors. As such, higher programming voltages, longer programming times,* <u>*and less effective programming may result from smaller nanoclusters that are less than 25 angstroms in diameter*</u>.

Second, Muralidhar does not teach exposing the silicon layer to a nitrogen-containing gas to form a nitride *barrier layer that is effective to inhibit passage of a dopant into the dielectric/oxide layer*.

Muralidhar teaches forming silicon nanostructures over the dielectric layer. However, each of those nanostructures are *separated* and *spaced apart*. This is illustrated in expanded view in **FIG. 21** below.

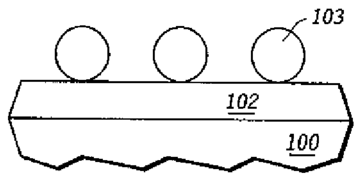

FIG.21

Muralidhar further discusses the sizing of the nanoclusters at 50 angstroms for 20% coverage of the dielectric layer – to provide *adequate spacing between the clusters* for a functional device (at col. 12, lines 50-67; emphasis added):

> ...In an embodiment where 50-angstrom diameter nanoclusters are utilized, a density of greater than $5X10^{11}$ nanoclusters per centimeter can be achieved using the formation techniques described herein. *In such an embodiment, the coverage, or area density of the nanoclusters on the underlying tunnel dielectric layer may be approximately 20%. The 20% area density is reasonable for semiconductor device manufacturing, as it provides a level of tolerance in the spacing between the nanoclusters included in the floating gate structures*. Although higher area densities may be achieved, the proximity of the isolated storage elements in such *higher area density embodiments may increase the probability of lateral charge transfer between nanoclusters, thus degrading the beneficial effects of their isolation.*

As such, the dielectric layer **102** is *exposed* – and in the illustrated example, about 80% of the layer is exposed. Accordingly, exposure of the structure of **Fig. 21** to a nitriding ambient results in silicon nitride formed on the nanostructures – but *not* over the dielectric layer **102**, as shown in **Fig. 23**.

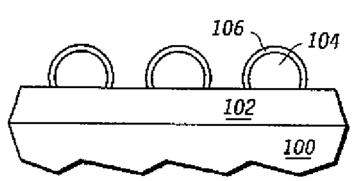

FIG.23

Muralidhar particularly addresses this at col. 16, lines 55-67 (emphasis added).

> Typically, the nitriding ambient used for forming the encapsulation layer 106 *does not affect the underlying tunnel dielectric layer 102 in a significant manner. As such, the nitriding step utilized to form the encapsulation layer 106 will not result in nitridation of the underlying tunnel dielectric layer 102.* ...

Consequently, Muralidhar does *not* teach Applicant's methods of

– exposing a silicon layer that is about 10-20 angstroms thick -- to a nitrogen-containing gas

– to form a nitride barrier layer that is effective to inhibit passage of a dopant into a dielectric/oxide layer.

Portions of the dielectric layer **102** in Muralidhar's device do not bear a silicon layer – nor a nitride barrier layer.

Muralidhar does not teach Applicant's methods as claimed. Accordingly, withdrawal of this rejection is respectfully requested.

Extension of Term. The proceedings herein are for a patent application and the provisions of 37 CFR § 1.136 apply. Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that Applicant has inadvertently overlooked the need for a petition for extension of time. If any extension and/or fee are required, please charge Account No. 23-2053.

It is respectfully submitted that the claims are in condition for allowance and notification to that effect is earnestly solicited.

Respectfully submitted,

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